

Epidemiology of sexually transmitted diseases: the global picture*

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Sexually transmitted diseases (STD) are now the commonest group of notifiable infectious diseases in most countries, particularly in the age group of 15 to 50 years and in infants. Their control is important considering the high incidence of acute infections, complications and sequelae, their socioeconomic impact, and their role in increasing transmission of the human immunodeficiency virus (HIV). The worldwide incidence of major bacterial and viral STD is estimated at over 125 million cases yearly.

STD are hyperendemic in many developing countries. In industrialized countries, the bacterial STD (syphilis, gonorrhoea, chancroid) declined from the peak during the Second World War till up to the late fifties, then increased during the sixties and early seventies, and they have been decreasing again from the late seventies till the present. In the industrialized world, diseases due to Chlamydia trachomatis, genital herpes virus, human papillomaviruses and human immunodeficiency virus are now more important than the classical bacterial ones; both groups remain major health problems in most developing countries.

Infection rates are similar in both women and men, but women and infants bear the major burden of complications and serious sequelae. Infertility and ectopic pregnancies are often a consequence of pelvic inflammatory disease, and are preventable. Sexually transmitted diseases in pregnant women can result in prematurity, stillbirth and neonatal infections. In many areas 1–5% of newborns are at risk of gonococcal ophthalmia neonatorum, a blinding disease; congenital syphilis causes up to 25% of perinatal mortality. Genital and anal cancers (especially cervical cancer) are associated with viral sexually transmitted diseases (genital human papillomavirus and herpes virus infections). Urethral stricture and infertility are frequent sequelae in men.

Introduction

Definition

Sexually transmitted diseases (STD) are a group of communicable diseases that are transferred predominantly by sexual contact; they are now the commonest group of notifiable infectious diseases in most countries. Despite some fluctuations their incidence remains unacceptably high. Over 20 pathogens are known to be spread by sexual contact (Table 1); some of them, like *Chlamydia trachomatis* and viral agents, are tending to replace the classical bacterial diseases

(syphilis, gonorrhoea and chancroid) in importance and frequency. These agents, which may be regarded as the second generation of sexually transmitted diseases, are frequently more difficult to identify, treat, and control, and can cause serious complications resulting in chronic ill-health, disability and even death (1).

Complications and sequelae

The list of complications and late sequelae associated with sexually transmitted diseases has increased considerably because many that were previously unsuspected have become apparent. They include adverse outcomes of pregnancy for mothers (post-partum salpingitis) and newborns (fetal death, prematurity, low birth weight), infections in newborns and infants like ophthalmia neonatorum and chlamydial pneumonia, sequelae of pelvic inflammatory disease such as infertility and ectopic pregnancy, sequelae of urethritis and epididymitis such as urethral stricture and male infertility, and cancers of the cervix, vulva,

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Table 1: Classification of sexually transmitted disease agents

1. Bacterial agents:
 - Neisseria gonorrhoeae*
 - Chlamydia trachomatis*
 - Treponema pallidum*
 - Haemophilus ducreyi*
 - Mycoplasma hominis*
 - Ureaplasma urealyticum*
 - Calymmatobacterium granulomatis*
 - Shigella* spp.
 - Campylobacter* spp.
 - Group B streptococcus
 - Bacterial vaginosis-associated organisms
2. Viral agents:
 - Human (alpha) herpesvirus 1 or 2 (herpes simplex virus)
 - Human (beta) herpesvirus 5 (cytomegalovirus)
 - Hepatitis B virus
 - Human papilloma viruses
 - Molluscum contagiosum virus
 - Human immunodeficiency virus (HIV)
3. Protozoal agents:
 - Entamoeba histolytica*
 - Giardia lamblia*
 - Trichomonas vaginalis*
4. Fungal agents:
 - Candida albicans*
5. Ectoparasites:
 - Phthirus pubis*
 - Sarcoptes scabiei*

penis and anus associated with human papilloma-virus type 16 and 18 or with human (alpha) herpes-virus 2 (1).

Epidemiology

The correctness of the incidence rate is determined by the accuracy and completeness of case reporting. The most comprehensive data on incidence come from a few industrialized countries. Sexually transmitted diseases are hyperendemic in many developing countries, including their rural areas where the facilities for diagnosis and treatment are usually inadequate. Incidence figures are therefore not reliable but prevalence data are available from *ad hoc* surveys in population groups that are not necessarily representative of the total population. These surveys provide useful estimates, but must be interpreted with caution.

Syphilis

United Kingdom. After the large peak during the Second World War, the number of cases of primary

and secondary syphilis dropped to a low level in the late 1950s. During the sixties and seventies a new increase was seen, but since 1978 a consistent drop in incidence has taken place (2, 3). The male/female ratio was 6 or 7:1 during most of the seventies and eighties, reflecting the high incidence in homosexual men, but has now decreased considerably, probably owing to changes in sexual behaviour in this group (3, 4). In general, female cases are younger, as shown by the male/female ratios of 1.7:1 and 14:1 for the under-16 and 35–44 years age groups, respectively (3).

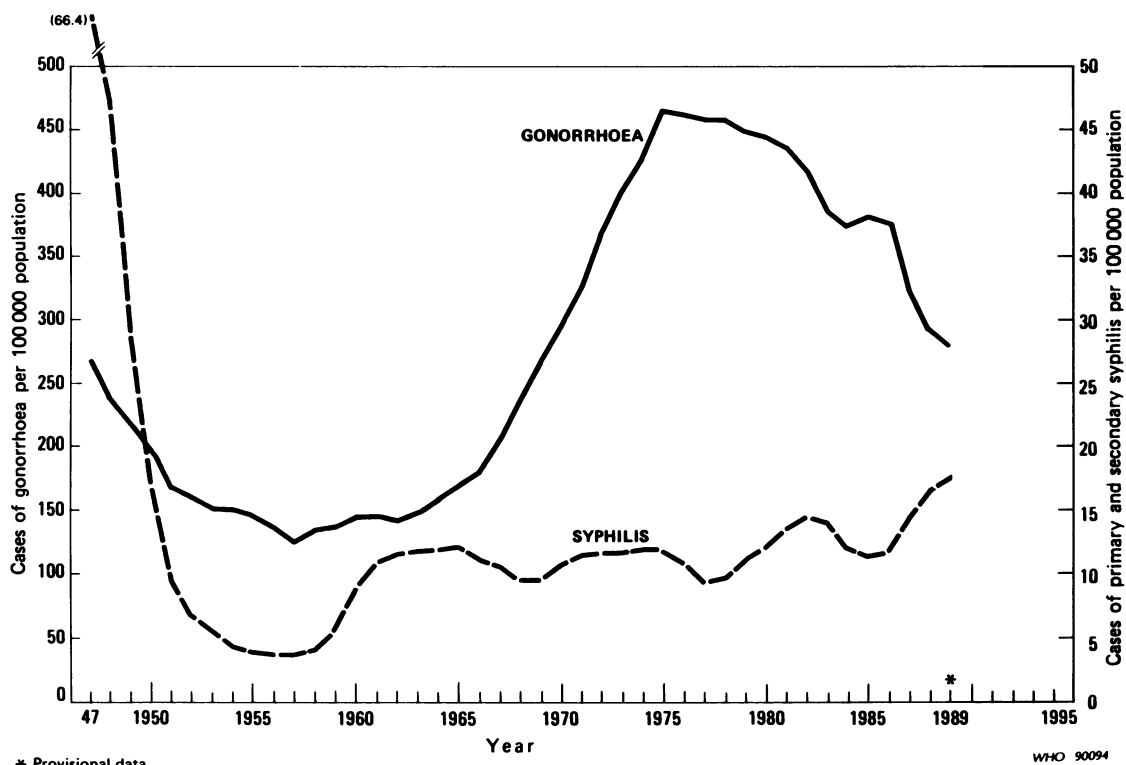
For late syphilis, the trends are different; the male/female ratio has been consistently around 2:1, a decrease being noted only since 1984 (3).

USA. After the large Second World War peak, a substantial decline in incidence of primary and secondary syphilis was observed, reaching an all time low in 1956 (Fig. 1). From 1956 up to 1965 there was a steady increase, followed by a roller-coaster course up to 1985. During that period the ratio of male/female cases increased from 1.5:1 in 1967 to 3.2:1 in 1980 and declined again to 2.6:1 in 1983 (5). White men were the only category in which a large increase was observed, but the highest rates were still in men of other ethnic groups. The proportion of white men with early syphilis who reported at least one male sex partner increased from 38% in 1969 to 70% in 1979 (5).

Between 1985 and 1989, however, a marked increase (more than 50%) was observed, going up to the highest figure since 1949 (6, 7). Local outbreaks of syphilis have emerged and have contributed to the national increase. These outbreaks occurred in Florida, New York City, and California, where heterosexual HIV seropositivity rates are highest (8). The largest proportion of this increase has been in heterosexual non-white males, while a decrease was observed in homosexual and bisexual men. This increase has been attributed to several factors, the most important being: (1) the increase of prostitution in which nonintravenous drugs (especially "crack", cocaine) are exchanged for sex, (2) the widespread use of spectinomycin rather than penicillin for the treatment of gonorrhoea, and (3) the shifting of resources from syphilis control to AIDS (9).

The highest age-specific incidence rates for primary and secondary syphilis were found in males aged 20 to 24 years; in general, no decline has been observed in any age group (6). Highest age-specific incidence in females was also found in the 20–24-years age group, but on average the women were younger. The male/female ratio varied from 0.4 to 4.8 for the 10–14 and 40–44-years age groups, respectively.

Fig. 1. Reported incidence of gonorrhoea and syphilis (primary and secondary) in the USA, 1947–89.



* Provisional data

WHO 90094

Incidence of total syphilis dropped substantially and reached an all-time low of 28.5 cases per 100 000 population in 1986. Since then, it has increased again, reflecting a higher incidence in primary and secondary syphilis.

Other industrialized countries. In Canada, trends are comparable to those in the United Kingdom (10). In the Netherlands, infectious syphilis was declining since 1982 (11), but recently an increase has been observed in heterosexual men and women (12).

Developing countries. Most available data are prevalence figures except for Singapore where good incidence data exist. In this country, incidence rates showed a decrease up to 1965, a steep increase up to 1970, and then a gradual decline to reach approximately 40 cases per 100 000 population in 1986 (13). Prevalence data from *ad hoc* surveys are given in Tables 2 and 3.

The interpretation of serological tests for syphilis is difficult since seropositivity can be due to venereal syphilis (infectious or noninfectious) or to previous infection with nonvenereal treponematoses;

in addition, false-positive results can occur with reagin tests. Nevertheless, the data in Tables 2 and 3 indicate a high prevalence of syphilis in many developing countries and a considerable risk of congenital syphilis in many areas.

Gonorrhoea

United Kingdom. The trends show a clear increase from 1957 onwards, reaching a peak in the early seventies and decreasing since, although not as steep as syphilis. The male/female ratio which was around 4:1 in 1950 was less than 1.5:1 in 1985. Women were mostly younger than men; the highest incidence among females was in the age group 16–19 years and for males in the group 20–24 years; the male/female ratio varied from 0.35:1 for under-16-year olds to 4.75:1 for those aged 45 years and over. The decrease in incidence was lowest in the group aged 16–19 years (2–4).

USA. After the Second World War, rates for gonorrhoea decreased sharply to its lowest level in 1957, after which a rapid increase took place, much more

Table 2: Percentage prevalence of a positive serological test for syphilis in women attending antenatal or family planning clinics and in the general population

Country and reference	VDRL/RPR ^a	TPHA/FTA-Abs ^b
<i>Attending antenatal clinics:</i>		
Central African Republic (14)	9.5	—
Chile (15)	3.5	—
Ethiopia (16) ^c	17.6	16.9
Fiji (17) ^c	—	9.1
Gambia (18)	15.0	11.0
India (19)	3.4	—
Malaysia (20) ^c	3.3	2.0
Malawi (21) ^c	17.6	13.7
Mozambique (18) ^c	8.2	6.3
Nigeria (22)	0.7	2.1
Rwanda (23)	4.4	—
Saudi Arabia (24)	1.0	0.9
Somalia (25)	3.0	3.0
South Africa (26) ^c	—	20.8
Swaziland (27)	10.0	33.3
United Republic of Tanzania (28) ^c	19.2	16.4
Zambia (29) ^c	14.3	12.5
Zaire (30) ^c	20.0	2.0
Zimbabwe (31)	0.5	—
<i>Attending family planning clinics:</i>		
Kenya (30)	0.0	2.0
Swaziland (27)	6.2	—
<i>General population:</i>		
Burkina Faso (18)	8.3	—
	18.4	—
	31.5	—
Gambia (rural) (18)	17.5	7.2
Somalia (rural): ^d		
Male	7.0	23.5
Female	31.5	22.5
Sudan (35):		
Male	35.2	—
Female	37.5	—

^a Venereal Disease Research Laboratory/Rapid Plasma Reagin card tests.

^b Treponemal haemagglutination test/Fluorescent treponemal antibody-absorption test.

^c TPHA/FTA-Abs only performed if VDRL was positive.

^d Data from S. Osman, *Sexually transmissible diseases in Somalia*. Thesis, University of Stockholm, 1988.

pronounced than in the United Kingdom. Between 1962 and 1975, the incidence increased steadily at about 15% per year, to reach an all-time high of 473 per 100 000 population in 1975. Since then, rates decreased again, particularly since 1987, probably related to fear of AIDS which led to a change in sexual behaviour (Fig. 1) (6, 7). The greatest percentage decline between 1975 and 1984 was among 25–44-year-old men of non-white race, but this group still had an incidence 10 times higher than in whites. The only increase occurred among white teenage women, but it is unclear if this is due to better diagnosis or a real increase.

Table 3: Percentage prevalence of a positive serological test for syphilis in female prostitutes

Country and reference	VDRL/RPR ^a	TPHA/FTA-Abs ^b
<i>Female prostitutes:</i>		
Gambia (18)	74.2	71.0
Kenya (32)		
Upper class ^c	—	37.0
Middle class ^c	—	31.0
Lower class ^c	—	53.0
Panama (33)	8.0	—
Somalia (25)	58.8	57.7
Uganda (34)	6.1	45.5

^a Venereal Disease Research Laboratory/Rapid Plasma Reagin card tests.

^b Treponemal haemagglutination test/Fluorescent treponemal antibody-absorption test.

^c TPHA/FTA-Abs only performed if VDRL was positive.

In 1987, women in the age groups 15–19 and 20–24 years had the highest incidence of gonorrhoea, nearly three times that of the group with the next highest frequency, those aged 25–29 years. Women accounted for 60% of cases of gonorrhoea reported in persons below the age of 20 years. This sex ratio was reversed in people above the age of 20 years. Among males, those aged 20–24 years had the highest incidence of gonorrhoea, 80% higher than that among those aged 25–29 years who were second highest (Fig. 2) (36, 37).

The male:female ratio of reported incidence increased to over 3:1 by 1966, then declined to 1.5:1 by 1973, and has remained more or less constant since then (37). In homosexual men, a sharp decline, particularly of rectal gonorrhoea has been observed since 1980 (38).

Other industrialized countries. In Denmark there was a steep increase of gonorrhoea incidence in the 1960s, followed by a steep decline in the seventies. A plateau

Fig. 2. Age-specific case rates of gonorrhoea for males and females in the USA, 1987.

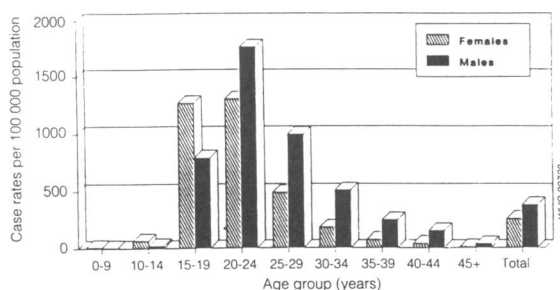
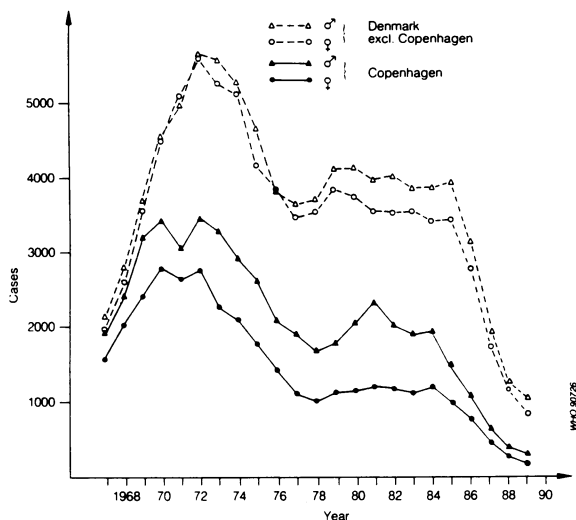


Fig. 3. Cases of gonorrhoea in Denmark, 1968–89 (reproduced with permission, Statens Seruminstitut, Copenhagen).



occurred until 1984, when an even more dramatic decline was seen (Fig. 3). This decline is observed both in men and women and both in Copenhagen and the rest of the country: particularly prominent is the decline in rectal gonorrhoea, which is ascribed to the change of homo- and bisexual men to a more "safe" sexual lifestyle.*

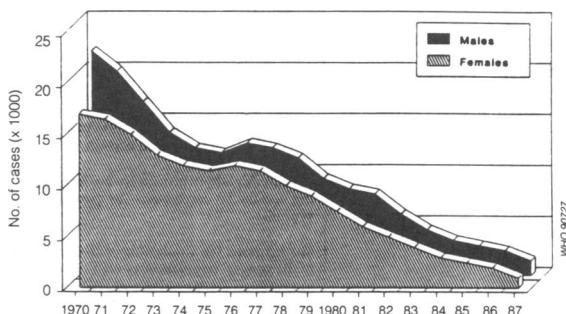
In Sweden, an almost continuous decline in incidence of gonorrhoea has been observed both in men and women, while the male/female ratio is constant at about one (Fig. 4) (39).

Developing countries. The available incidence figures are unreliable, but estimates for large cities in Africa suggest an annual incidence rate for gonorrhoea of 3000–10 000 cases per 100 000 inhabitants (40, 41). Prevalence surveys provide useful estimates, but must be interpreted with caution. In Table 4 is summarized the prevalence of gonorrhoea in women attending prenatal clinics and family planning clinics and in prostitutes.

C. trachomatis infection

Although trends in the incidence of proven *C. trachomatis* infections cannot yet be defined, trends in

Fig. 4. Cases of gonorrhoea in Sweden, 1970–87 (reproduced with permission, Department of Epidemiology, National Bacteriological Laboratory, Stockholm).



the incidence of non-gonococcal urethritis (NGU) in men provide a reasonable approximation, since the proportion of cases attributable to *C. trachomatis* infection has remained fairly constant, at least in industrialized countries, at about 40% in various studies during the last decade (1).

United Kingdom. Since 1966, rates for non-gonococcal urethritis have steadily gone up and are now four times higher than those for gonorrhoea in men and more than three times for women. Some of the increase may have been due to the recording of "epidemiological treatment". There has been a steep rise in laboratory reports of genital *C. trachomatis* infection, which probably reflects the wider availability of chlamydial diagnostic testing; reports of infection of *C. trachomatis* in women, for instance, rose over fivefold from 3500 in 1981 to 18 500 in 1986 (3).

USA. Genital infection caused by *C. trachomatis* is the most common bacterial STD in the USA today (38, 58). In 1972, the number of visits to private physicians' offices for NGU surpassed that for gonorrhoea; the gap has widened in recent years, NGU now being three times as common as gonococcal urethritis. In 1986, based on using *Neisseria gonorrhoeae* as a surrogate, *C. trachomatis* was estimated to cause over 4 million infections (59). The number of infections was estimated to be larger among women (2.6 million) than among men (1.8 million) (38, 59). Considerably higher chlamydia/gonorrhoea ratios were found among whites, pregnant women, oral contraceptive users and asymptomatic individuals; lower ratios were found among homosexual men (59, 60).

* Lind, I. et al. Activities of the WHO Collaborating Centre for Reference and Research in Gonococci, Copenhagen, for the year 1987. Unpublished report WHO/VDT/RES/GON/88.151, 1988.

Table 4: Percentage prevalence of gonorrhoea in pregnant women, women attending family planning clinics, and female prostitutes

Country and reference	Prevalence
Pregnant women:	
Cameroon (42)	15.0
Central African Republic (14)	9.5
Fiji (17)	2.3
Gambia (43)	6.7
Gabon (44)	5.5
Ghana (45)	4.4
Jamaica (46)	11.0
Kenya (47)	6.6
Malaysia (48)	0.5
Nigeria (49)	5.2
Senegal (50)	2.1
Singapore*	0.8
South Africa (26)	11.7
Swaziland (27)	3.9
United Republic of Tanzania*	6.0
Thailand (48)	11.9
Uganda (51)	40.0
Zambia (52)	11.3
Zimbabwe (53)	7.0
Women attending family planning clinics:	
Kenya (54)	17.0
Kenya (55)	3.5
Nigeria (49)	3.6
United Republic of Tanzania (56)	7.1
South Africa (57)	10.2
Swaziland (27)	2.0
Female prostitutes:	
Kenya (32):	
Upper class	22.5
Middle class	55.9
Lower class	64.8
Panama (33)	11.2

* From E. Sng, unpublished observations, 1987.

* From E.J.N. Urassa. Some aspects of sexually transmitted diseases in obstetrics and gynaecology. *Proceedings of the Symposium on Sexually Transmitted Diseases, Dar es Salaam, September 1985*, pp. 23–28.

Other industrialized countries. Prevalence of chlamydial urethral infection ranges from 3–12% among asymptomatic men attending different health facilities to 15–20% for all men seen at STD clinics. The prevalence is strongly correlated with young age and heterosexual rather than homosexual preference (61). In Sweden, incidence of chlamydial infections is highest in women aged 20–24 years; most striking is that in all age groups the incidence is higher in females (Fig. 5) which may be related to intensive case-finding particularly in women (39).

Developing countries. Until recently, the spectrum of STD commonly identified in developing countries was limited to the classical “venereal” diseases. However, sexually transmitted pathogens of the

Fig. 5. Reported genital chlamydial infections in Sweden, 1986 (reproduced with permission).

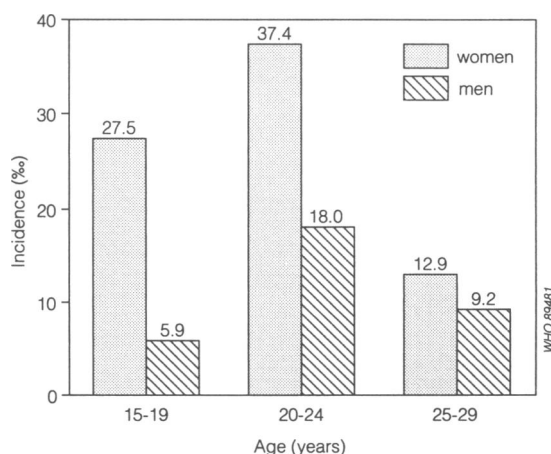


Table 5: Percentage of pregnant women with serological/bacteriological evidence of *C. trachomatis*

Country and reference	Serology	Culture
Fiji (17)	—	45.1
Gabon (62)	—	9.9
Gambia (63)	—	6.9
Ghana (45)	25.3	7.7
Kenya (47)	—	29.0
Nigeria (64)	—	6.5
Somalia (65)	—	18.8
South Africa (66):		
Urban	—	12.5
Rural	—	1.3
Thailand (67)	—	12.8
Zimbabwe (53)	—	9.9

second generation have started to be identified in developing countries and the prevalence of *C. trachomatis* infections is summarized in Tables 5 and 6. In general, in developing countries, the prevalence of *C. trachomatis* infections in women is similar to the rates in industrialized countries, while the infection rates for men with urethritis seem to be lower. As these agents cause a more indolent infection, patients are not motivated to seek treatment, which is an important factor in the rapid spread of chlamydial infection and the development of complications.

Genital herpesviral infection

United Kingdom. Since genital herpes (alphaherpesviral infection) became a reportable disease in 1970, the numbers have increased from less than 4000

Table 6: Prevalence of *C. trachomatis* infection in certain groups of the male and female populations

Population, country and reference	<i>C. trachomatis</i>	
	Isolated (%)	Antibodies (%)
Men with urethritis:		
South Africa (66)	19.2	—
Swaziland (66)	2.7	—
Singapore (68)	30.2	—
Gambia (63)	15.4	—
Iran (69)	8.8	15.7
Gabon (62)	16.3	—
Men treated for gonorrhoea:		
Singapore (68)	19.2	—
Central African Republic (70)	5.0	—
Kenya (54)	8.9	78.6
Men attending STD clinics:		
Ethiopia (71)	—	45.3
Nigeria (72)	—	18.7
Sudan (73)	—	4.4
Women with vaginal discharge:		
Gabon (62)	17.9	—
Gynaecological outpatients:		
China (74)	1.0	—
Ghana (45)	4.9	—
Gambia (63)	13.6	—
Women at STD clinics:		
South Africa (66)	13.3	—
Ethiopia (71)	—	32.4
Nigeria (72)	—	26.7
Sudan (73)	—	10.4
Patients with PID:^a		
Singapore (68)	14.0	—
Gabon (62)	14.3	—
Women attending FPC:^a		
South Africa (66)	16.1	—
Nigeria (72)	—	35.0
Kenya (55)	12.0	—
Unmarried women seeking abortions:		
Singapore (75)	14.0	—
Infertile women:		
Gabon (62)	9.6	—
Prostitutes:		
Kenya (54)	4.9	—
Somalia (65)	32.8	—
Singapore (68)	10.0	—

^a PID = pelvic inflammatory disease; FPC = family planning clinic.

in 1971 to almost 20 000 in 1985 (76). Since then, a slight decline has been noted; this could be related to the more widespread use of acyclovir to prevent recurrences of the disease (4).

USA. There has been a 15-fold increase in the total

number of physician-patient consultations for genital herpes (from 30 000 to over 450 000) (Fig. 6) between 1966 and 1984, since when it has levelled off (6). These data must be interpreted with caution for several reasons, particularly in the USA. First, recent media attention—especially since 1982—may have increased both physicians' and patients' awareness of the signs and symptoms of genital herpes, thus inflating the number of patients seen in recent years. Second, a patient seen by a physician for the first time for genital herpes may not actually represent a newly diagnosed case. Third, asymptomatic infections are not reported. Using a number of assumptions, consultants to the U.S. National Academy of Sciences estimated that approximately 724 000 new cases of genital herpes occur annually in the USA with a cumulative prevalence of over 20 million infected persons (77).

Genital human papillomavirus (HPV) infection

The epidemiology of HPV is similar to that of genital herpes except that its magnitude is three to fourfold greater. As genito-anal cancers, in particular cervical cancer, are a major consequence of genito-anal HPV infections, this makes them much more important from the public health point of view.

United Kingdom. The incidence of genital warts increased from 30 per 100 000 population in 1970 to 260 per 100 000 in 1988, an almost ninefold increase. This means that they are now the second most frequently reported STD in the United Kingdom after non-gonococcal urethritis. The increase has been larger in males than in females and also the rates in males are almost double those in females (3).

USA. The number of physician-patient consultations

Fig. 6. Genital herpesviral infection: number of visits to private physicians in the USA, 1966–87.

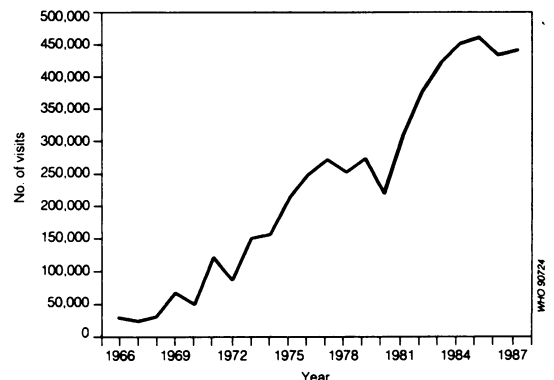
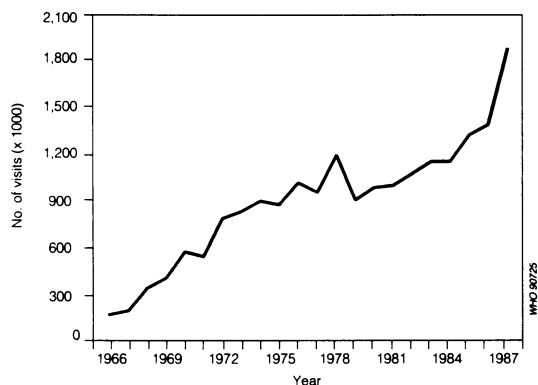


Fig. 7. Genital human papillomavirus infection: number of visits to private physicians in the USA, 1966–87.



for this condition increased tenfold between 1966 and 1987, from 169 000 to over 1 800 000 (Fig. 7) (6). Persons aged 20–24 years had more consultations for genital warts than did patients in other age groups; visits for women outnumbered those for men. Even more than for genital herpes, genital warts represent only the symptomatic top of the iceberg of HPV infections. First, as physician awareness increases, subclinical papillomavirus infections are becoming commonly recognized. Second, no serological test is available and the virus cannot be recovered through tissue culture.

Chancroid

The global incidence of chancroid greatly exceeds that of syphilis (78). A resurgence of interest in chancroid has occurred since a selective medium for the isolation of *Haemophilus ducreyi* was developed. This allowed better identification of patients with the disease and further studies of the epidemiology, clinical management and microbiology of the pathogen.

United Kingdom. During the last fifteen years, fewer than 100 cases have been reported annually and no increase has been observed (4, 78).

USA. The number of chancroid cases peaked in 1947 (when 9515 cases were reported) and decreased between 1948 and 1978. This trend was reversed in 1978 and the increase accelerated between 1981 and 1983 when a large outbreak with 923 cases was reported from California (79). The increased frequency of such outbreaks in recent years has led to a net increase in the incidence of these infections. Chancroid is recognized far more frequently among men than among women. In 1987 the male:female sex ratio was 5.8:1 for reported cases of chancroid (6). This could be explained by frequent prostitute contact repeatedly

being implicated in chancroid outbreaks (79). In 1985, the number of reported cases rose above 2000 for the first time since 1956 and in 1987 almost 5000 cases were reported (7, 80).

Developing countries. Prostitutes play a very important role in the spread of chancroid which is highly endemic in many tropical countries, particularly in south-east Asia and eastern and southern Africa. At the Special Treatment Clinic in Nairobi, Kenya, more than 5000 patients a year are seen with chancroid, prostitutes and casual sex partners accounting for 57% and 36% of sources of this infection, respectively (81). This study also indicated that women who transmit *H. ducreyi* have clinical chancroid lesions, since all female source contacts of men with chancroid had genital ulcers. Chancroid lesions are also highly infectious, with 63% of secondary contacts of male chancroid cases being infected with *H. ducreyi* or showing genital ulcers. These results, however, should be interpreted with caution because the number of source and secondary contacts was very small (10 female source contacts and 29 female secondary contacts for 300 index cases). Genital ulcers are prevalent in lower and middle class prostitutes, e.g., 10% in Nairobi (4% were culture-proven chancroid); a further 4% of prostitutes were symptomless genital carriers of *H. ducreyi*, but their role in transmission is not clear (32). In other areas, it was shown in Singapore that the incidence of chancroid is declining, parallel with socioeconomic development (82), while in El Salvador it seems to be increasing (83).

Recently, an enzyme immunoassay for detecting serum IgG antibody to *H. ducreyi* was developed using an ultrasonicated whole-cell antigen. The value of this test for diagnostic purposes has still to be assessed, but it could be a valuable tool for epidemiological studies on *H. ducreyi* infection (84).

Genital ulceration due to any of the three classical etiological pathogens—*H. ducreyi*, *Treponema pallidum* or human herpes virus 2—can be extremely variable in appearance and, in the absence of diagnostic tests, the clinical diagnosis is unreliable. In Africa, even in areas where syphilis is highly prevalent, most genital ulcers are due to chancroid (Table 7) (1, 85). In the Gambia 10% of patients with genital ulcers had both chancroid and syphilis (85), and in Nairobi both infections occurred concurrently in 5% of patients with genital ulcers (86). Owing to the unreliability of clinical diagnosis and the frequent presence of the two agents in the same genital ulcer, appropriate chancroid treatment combined with syphilis therapy has been recommended.^b

^b WHO Working Group. Simplified approaches for sexually transmitted disease control at the primary health care level. Unpublished document WHO/VDT/85.437, 1985.

Table 7: Etiology of genital ulcerations in consecutive patients in four African countries*

Diagnosis	Patients (%)			
	Swaziland (n=149)	South Africa (n=102)	Kenya (n=97)	Gambia (n=104)
Chancroid	42	58	62	52
Syphilis	17	15	9	22
Herpes	11	8	4	6
Chlamydial lymphogranuloma	12	1	—	7
Granuloma inguinale	1	1	—	—
Mixed etiology	4	3	2	—
Other and unknown	13	14	23	27

* Source: references 1 and 85.

Granuloma inguinale (donovanosis)

This disease is extremely rare in industrialized countries. In the United Kingdom, less than 50 cases per year are being reported (3). In the USA the number of cases dropped dramatically from 2403 in 1947 to less than 50 in the early 1980s (6), most cases occurring in the black population living in the southeast (87). Unlike chancroid, no increase has been observed recently (6).

The disease is endemic in Papua New Guinea, central Australia, the Caribbean and the eastern coast of India (88), and epidemics have been reported in Papua New Guinea and South America as well as in the Caribbean and many other tropical or sub-tropical environments (89). Throughout the world poor hygiene and low income have been associated with donovanosis (89).

Complications in adults

Pelvic inflammatory disease (PID)

Industrialized countries. The epidemiology of PID has been extensively studied in Lund, Sweden. The etiologic spectrum of salpingitis in the industrialized world indicates the overwhelming importance of STD organisms. In Sweden, in 15–24-year-old women the etiology is as follows: *C. trachomatis*, 40–60%; *N. gonorrhoeae*, 15–18%; *Mycoplasma hominis*, 10–15%; anaerobes, 3–5%; and unknown etiology, 10–15% (90, 91).

In Sweden, the incidence of salpingitis went up by 10% per year from 1955 to 1974 and declined by 5% per year between 1975 and 1984. The incidence is still highest in the 15–19-years age group. The etiologic spectrum showed a shift from *N. gonorrhoeae* to *C. trachomatis* between 1955 and 1984; in 1959, 24% of all pelvic inflammatory disease was

associated with gonorrhoea, and in 1984 this was 5%; *C. trachomatis* is now responsible for approximately 80% of salpingitis cases of known origin (92, 93). In the United Kingdom, discharge rates for acute salpingitis and PID increased from 97/100 000 in 1968 to 160/100 000 in 1979 in the age group 20–24 years; global incidence rates for PID increased by 50% between 1968 and 1977 (94).

In the USA, it is estimated from various sources that each year more than one million women experience an episode of PID, of which nearly 300 000 are hospitalized (95). The number of visits to private physicians for PID peaked in 1973 and declined subsequently in all age groups (96). However, hospitalization for this condition rose slightly between 1975 and 1981. Striking increases in hospitalization occurred among women aged 15–24 years, particularly white women (97).

Developing countries. The frequency of PID in the Third World is not very well documented but the yearly incidence in some parts of Africa has been estimated at 360 cases per 100 000 (98); in Papua New Guinea, it is thought that 15% of gynaecological admissions and 40% of attendances at gynaecological outpatients departments are due to PID (99). In Africa, *C. trachomatis* and *N. gonorrhoeae* are the two most frequently isolated pathogens in PID (100, 101). The relative importance of *C. trachomatis* was recently confirmed in a study in Gabon where 49% of women with laparoscopically confirmed acute salpingitis had evidence of chlamydial etiology (102).

Maternal infection

In the USA the incidence of postpartum endometritis (PPE) ranges from 1% to 7% after vaginal delivery and from 20% to 65% after caesarean section (103). While there is no doubt about the role of *N. gonorrhoeae* as an important pathogen for PPE, studies implicating *C. trachomatis* show conflicting results (104, 105).

In developing countries PPE remains an important cause of maternal morbidity and death (98). Thus, in Kenya, it was shown in a prospective study that the incidence of postpartum upper genital tract infections was 20.3%, the development of which was significantly correlated with gonococcal or chlamydial infection, presence of ophthalmia neonatorum, labour lasting for more than 12 hours, and the area of residence. Approximately 35% of these upper genital tract infections observed were due to *N. gonorrhoeae*, *C. trachomatis* or both (106).

Ectopic pregnancy

The risk of ectopic pregnancy increases approximately 7–10-fold after one or more episodes of PID

(91). In the USA the number of such pregnancies more than quadrupled between 1970 and 1985; in 1985 the rates were 15.2/1000 pregnancies. Highest rates were found in women above 30 years. During the period 1984–85 women of black and other races had a fourfold higher risk for ectopic pregnancy-related deaths than did white women. The racial disparity in case-fatality rates has been increasing since 1981–83 (107, 108). In Canada, the number of such pregnancies increased by 63% from 1970 to 1980 (109).

The incidence of ectopic pregnancy is higher in Third World countries than in industrialized countries. In Jamaica, from 1981 to 1983 it was the third leading cause of maternal mortality (110).

Infertility

Infertility in women. STD and subsequent pelvic inflammatory disease can lead to infertility in women owing to post-infection tubal obstruction. The incidence of infertility after first, second and third episodes of PID in women has been calculated to be 13%, 35% and 75%, respectively (91). There is increasing evidence that chlamydial infections play an important role in PID because they are generally less symptomatic than gonococcal infections; tubal damage caused by chlamydial PID is equal to or greater than that caused by gonococcal PID (111).

In the USA, between 1965 and 1982, there was a significant increase in infertility among couples where the wife was aged between 25 and 29 years. The largest increase was seen in black couples where the wife was between 20 and 24 years (1).

In Africa, the prevalence of infertility is remarkably widespread, occurring in a broad central zone including Cameroon, Central African Republic, south-western Sudan, northern Zaire, Congo and Gabon, the so-called infertility belt (112). Also the pattern of infertility is different in Africa from the rest of the world. A WHO multicentre study has shown that the rate of bilateral tubal occlusion was three times higher in Africa than in Asia or the industrialized countries; 60–85% could be attributed to PID. The etiologic organisms were *N. gonorrhoeae* and, increasingly, *C. trachomatis* (113–115).

Infertility in men. Urethritis in the male can lead to epididymitis (commonly bilateral) and total azoospermia by complete obstruction (116). The latter is rare in industrialized countries but extremely common in Africa (117). In Uganda, 28% of a community sample of men had evidence of chronic epididymitis, of which 6% was bilateral; in Lagos, Nigeria, 40% of the husbands of women attending an infertility clinic were infertile themselves, and most of them gave a

history of two or more attacks of urethritis which was either untreated or undertreated (118).

Complications in children

Congenital syphilis

Congenital syphilis causes fetal and perinatal death in 40% of the infants affected (119). Trends in the USA show a steady decrease in the 1950s and 1960s, followed by a substantial increase during recent years (119), reaching 1 per 10 000 live-born infants in 1986 (120); the proportion of stillbirths is unknown (119). This increase probably reflects increased vertical transmission due to inadequate prenatal care and the recent rise in syphilis affecting heterosexual non-white women (38, 120).

In developing countries, congenital syphilis is a priority public health problem. Rates are 700/100 000 live births in Bangkok, 850/100 000 in Lusaka, and 3200/100 000 in Addis Ababa (16, 30, 121). In Zambia, 8.6% of the infants aged less than 3 months admitted to hospital had congenital syphilis, as had 7.5% of neonates admitted to intensive care units (18).

Spontaneous abortion and stillbirth. The most common outcome of syphilis during pregnancy is probably spontaneous abortion during the second and early in the third trimester. In most industrialized countries, the prevalence of syphilis in pregnant women is so low that this does not cause a problem (122). In most developing countries, stillbirths due to syphilis are a large problem owing to the high prevalence of infection in pregnant women and lack of or inadequate antenatal care.

In Zambia, 19% of miscarriages are attributed to syphilis, while in Ethiopia, pregnant women who were found to be seroreactive to syphilis were five times more likely to have an abortion or stillbirth than women who were seronegative (29, 123). A case-control study from Zambia demonstrated a 28-fold increased risk for stillbirths among women with a high-titre RPR (rapid plasma reagin) card test seroreactivity (124).

Perinatal, neonatal and infant deaths. In Zambia, congenital syphilitic infection is implicated in 20–30% of the total perinatal mortality which is 50 per 1000 births (52). This probably underestimates the problem because postneonatal infant deaths are not included and because many stillborn infants do not have clinical evidence of congenital syphilis (125).

Neonatal conjunctivitis

Ophthalmia neonatorum is defined as conjunctivitis

with discharge within the first 28 days of life, acquired by the neonate during passage through the infected birth canal. This complication can rapidly cause blindness (126). The incidence and etiologic spectrum differ in various parts of the world, depending on the relative prevalence of maternal gonococcal and chlamydial infections and the use of ocular prophylaxis. *C. trachomatis* has replaced *N. gonorrhoeae* as the most important single etiology even in developing countries, causing up to 32% of all cases (47, 127). The transmission rate from an infected mother to the newborn is 30–45% for *N. gonorrhoeae* and 30% for *C. trachomatis* (47, 128).

The incidence of neonatal gonorrhoeal conjunctivitis dropped in industrialized countries more than a century ago from 10% to 0.3%, thanks to the introduction of Credé's silver nitrate prophylaxis (129). In Denmark, silver nitrate prophylaxis was abandoned in March 1985, resulting in a slight increase in incidence of ophthalmia neonatorum from 0.3 to 1/1000 live births.^c In some developing countries also this prophylaxis was abandoned and has led to a very high incidence of gonococcal ophthalmia neonatorum, as much as 5% of births in some places. Reintroduction of prophylaxis drastically reduced the incidence—by 83% when using silver nitrate and by 93% when using tetracycline ointment (130). It is therefore very necessary to reintroduce this prophylaxis and to enforce it.

Prematurity, low birth weight, neonatal and infant infections

Prematurity is still an important cause of neonatal death, mostly as a consequence of infection. The etiologic link with *N. gonorrhoeae* and *C. trachomatis* is suspected but has not been clearly established (104, 105, 131, 132). Apart from *T. pallidum*, other STD pathogens also can cause neonatal and infant infection.

Neonatal gonococcal infection can result in disseminated infection such as meningitis, arthritis and sepsis (133). Infants born to *C. trachomatis* culture-positive mothers develop nasopharyngeal infection in 15–20% and pneumonia in 3–18% (134–136). Group B streptococcus infection is an important cause of neonatal sepsis and meningitis (137). Infection with human (alpha) herpesvirus 1 and 2, human (beta) herpesvirus 5 (formerly cytomegalovirus) and syphilis is an important cause of the so-called TORCHES syndrome which is associated with a high mortality rate in the neonate (138).

Conclusions

Few fields of medicine have shown changes as much as the sexually transmitted diseases. During the last 40 years, the burden of a number of traditional venereal diseases like gonorrhoea, syphilis and chancroid has declined, particularly in the industrialized countries, but they have been amply replaced by both bacterial and viral syndromes associated with *C. trachomatis*, human (alpha) herpes virus, human papillomavirus, and human immunodeficiency virus. These agents, regarded as the second generation of sexually transmitted organisms, are frequently more difficult to identify, treat and control, and they can cause serious complications, some of which result in chronic ill-health, disability and death.

STD control programmes have been and will continue to be in the forefront of public health management. Strategies to prevent transmission of organisms spread by intimate human contact must remain flexible and adapt to the social, technical, clinical, financial and political realities. A strategy of primary prevention, based on sexual behavioural change combined with the provision of adequate clinical services, is vital for the control of STD (1). High priority should therefore be given to the integration of STD control measures into primary health care. The worldwide interest in and resources committed to preventing AIDS provide a unique opportunity for health workers to make considerable progress in controlling the other sexually transmitted diseases as well.

Résumé

Epidémiologie des maladies sexuellement transmissibles dans le monde

La forte progression de l'incidence des infections imputables à des agents sexuellement transmissibles représente l'un des plus sérieux échecs que la médecine ait enregistrés depuis 30 ans. Certains agents pathogènes (*Chlamydia trachomatis*, les herpesvirus alpha humains de type 1 ou 2, les virus des papillomes humains, le virus de l'hépatite B et le virus de l'immunodéficience humaine) tendent à supplanter en importance et en fréquence les maladies bactériennes classiques (syphilis, gonococcie et chancre mou).

Les MST sont hyperendémiques dans de nombreux pays en développement, et ce également dans les zones rurales qui sont les moins bien équipées pour assurer le diagnostic et le traitement approprié. La gonococcie y est la seconde maladie infectieuse après la diarrhée.

^c See footnote a on page 643.

Dans les pays industrialisés en général, l'incidence des MST "classiques" (gonococcie, syphilis et chancre mou) avait beaucoup diminué après la Seconde Guerre Mondiale.

Elle avait ensuite augmenté durant les années 60 et 70 pour baisser de nouveau jusqu'à son niveau actuel. Ces dernières années, on a observé qu'aux Etats-Unis l'incidence de la gonococcie a diminué dans tous les groupes à risques, mais qu'il y a une progression considérable de la syphilis chez les hétérosexuels.

Les tendances relevées dans le cas des urétrites non gonococciques masculines fournissent une approximation de l'incidence des infections à *C. trachomatis*. L'incidence de l'urétrite non gonococcique chez les hommes, est aujourd'hui quatre fois plus élevée que celle de la gonococcie.

Quant aux infections à *C. trachomatis* dans les pays en développement, elles sont fréquentes, surtout en Afrique où elles sont parfois même plus fréquentes que la gonococcie.

L'incidence notifiée de l'herpès génital a triplé depuis 1971. On a estimé qu'aux Etats-Unis le nombre des consultations privées pour herpès génital avait été quinze fois plus élevé en 1987 qu'en 1966, et que celui des consultations pour condylomes génitaux avait été multiplié par sept au cours de la même période. Toutefois, les consultations pour condylomes génitaux étaient encore 2 à 3 fois plus nombreuses que celles pour herpès génital en 1984.

L'incidence globale du chancre mou est plus élevée que celle de la syphilis. La maladie est hyperendémique dans beaucoup de pays tropicaux, notamment en Asie du Sud-Est et en Afrique orientale et australe.

L'épidémiologie des infections génitales hautes a été étudiée, notamment en Suède où l'incidence de ces affections a progressé d'environ 10% par an de 1955 à 1975, avant de diminuer ensuite.

L'incidence des infections génitales hautes a été estimée à 360 cas pour 100 000 habitants dans certaines régions d'Afrique.

Le risque de grossesse extra-utérine est environ 7 à 10 fois plus élevé après un ou plusieurs épisodes d'infection génitale haute. Aux Etats-Unis, le nombre de grossesses extra-utérines a quadruplé entre 1970 et 1985. Au Canada, il a augmenté de 63% de 1970 à 1980.

Aux Etats-Unis, on a observé une augmentation considérable des cas de stérilité entre 1965 et 1985.

Les causes de stérilité tubaire qui indiquent surtout une étiologie infectieuse représentent 36% de l'ensemble des cas dans les pays indus-

trialisés, contre 39% en Asie et 85% en Afrique. Les infections en cause, sont, en Afrique comme ailleurs, la gonococcie et *C. trachomatis*.

Aux Etats-Unis, le nombre d'enfants atteints de syphilis congénitale a diminué dans les années 50 et 60. Néanmoins, depuis 1984, on observe une augmentation du nombre des cas.

Dans beaucoup de pays d'Afrique, cette maladie est toujours très répandue; jusqu'à 5% des enfants nés vivants sont touchés et un tiers des mortalités sont dues à cette maladie.

La cause la plus grave de conjonctivite du nouveau-né est l'infection par *N. gonorrhoeae* qui peut rapidement provoquer la cécité. Cette maladie est devenue rare dans les pays industrialisés, par suite de la prophylaxie oculaire systématique et de la faible prévalence de la gonococcie chez les femmes enceintes. En revanche, dans certains pays en développement l'ophtalmie gonococcique du nouveau-né constitue de nouveau un problème prioritaire, surtout lorsque la prophylaxie oculaire a été abandonnée ou n'est pas systématiquement appliquée.

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